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Influence of sociodemographic factors on the risk of unintentional childhood home injuries

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Background: While social differences in childhood injuries are recognized, less is known about how social and demographic differences relate to injury mechanism. The purpose of the study was to reveal how sociodemographic factors affect the incidence of unintentional home injuries in Danish children for specific injury mechanisms and involved products. **Methods:** Information on injuries in 173 504 children treated at emergency departments was recorded for the period 1998–2003. The information was linked to data including parents' education and income and family type, and the results were compared with those for a random sample of the population. **Results:** A total of 50 561 injuries were analysed. The risk was 1.5 (1.5–1.6) for children with mothers having only primary education compared to tertiary education, and 1.5 (1.4–1.6) for children in families with the lowest vs. the highest income. Risk differences were found for all injury mechanisms; however the risk for burns was 1.9 (1.6–2.3) times higher in the lowest-income group than in the highest-income group, the relative risk for poisoning was 1.7(1.4–2.1). For scalds from hot water, tea or coffee, the relative risk for the lowest-income group was 2.4(1.8–3.2). Living in a one- or two-parent family and size of the dwelling had little or no effect on risk. **Conclusion:** Childhood injury incidence depended on sociodemographic factors. The effect of the sociodemographic factors varied between injury mechanisms and products involved in the injury.

Keywords: burns, child, injuries, poisoning, sociodemographic factors

Introduction

The incidence of injury in childhood depends on socio-demographic factors. Studies have shown an increased risk among children living in deprived areas, e.g.[1–3] Studies at the individual level have shown that low-social class and short-parental education,[4,5] many siblings,[6,7] a young mother[8,9] and a single parent household[9–12] are associated with an increased risk of injury in childhood. In a study from Switzerland the only sociodemographic factor of importance for injuries in children up to 5 years was the size of the dwelling.[13]

The observed association between sociodemographic factors and injury rate shows a potential for reducing the injury incidence among children towards the level of the most privileged children. Further it may identify groups at particular high risk, so that injury prevention can be targeted to these. A major share of childhood injuries occurs at home, and here factors related to the family and dwelling may affect the injury incidence. To consider the potential for preventing childhood injuries, more information on the relation between the socio-demographic factors and the risk of injuries related to specific mechanisms and products is needed. This information was obtained by linking the Danish Injury Register, which contains detailed information on injuries collected from emergency departments, with information from Statistics Denmark on sociodemographic conditions at the individual level. The purpose of the study was to reveal how sociodemographic factors affect the incidence of unintentional home injuries in Danish children for specific injury mechanisms and involved products.

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Methods

The study population consisted of children living in 32 municipalities in Denmark during the period 1998–2003. The municipalities were within the catchment areas of hospitals located in the cities of Glostrup, Herlev, Frederikssund, Esbjerg and Randers, from which injury data are collected for the Danish Injury Register. Children were included if they lived in one of the municipalities one of the years 1998–2003, and if they were aged below 15 years. Only whole child years were included. The municipalities were distributed over four counties in Denmark, and their population can be considered as representative of that of the whole of Denmark with regard to social composition, on the basis of information from Statistics Denmark (table 1).

Information on the injury events was coded by specially trained secretaries at the five emergency departments. Injury mechanism, place of the accident, involved products and other information were coded in detail, as described elsewhere.[14] Only injuries occurring in residential and surrounding areas were included. We considered the following types of home injuries: all injuries; injuries followed by admission to hospital; injuries caused by falls from 1 m or more; pinching/crushing injuries; burns by hot liquids, steam, hot surfaces or fire; accidental poisoning or corrosion by solids or liquids; injuries due to selected products.

We linked sociodemographic information from Statistics Denmark to all children in the 32 municipalities in contact with the five hospitals and for a 25% random sample of children in the area. The record linkage was based on the children's and their parents' civil registration numbers. Children who were not living with any of their parents were excluded.

In addition to information related to social status, information on some other factors which are known to influence or confound the injury risk and usage of Emergency Departments (EDs) among children were included, such as number of children in the household[7] and the distance to the hospital.[15,16] Further, information on the dwelling type and crowding was included as both may be hypothesized to be of importance for the incidence of home injuries.

In total, the information included:

- highest educational level of the adults in the household: primary education (9–10 years), secondary education (11–14 years) or tertiary education (≥15 years), based on mandatory reporting from the educational institutions. For immigrants the information was obtained by questionnaires, and non-responder data were assigned by imputation;
- highest annual income among the adults in the household, based on taxation information;
- family type (living with one or two of the parents, or in a stepfamily), based on the population register;
- mother's age at the birth of the child;
- number of children under 18 years in the household, based on the population register;
- dwelling type: flat, detached or terraced house or farmhouse (related to active farming), based on the Building and Dwelling Register (data obtained by questionnaires and mandatory reporting of changes);
- crowded dwelling: one or more persons per room (yes/no), obtained by combining the information above;
- distance from the centre of the municipality to the nearest hospital, in four groups.

The incidence rate for a selected population group and injury type was calculated as the number of emergency department visits, divided by the total number of child years in the population. The rates were adjusted for age to correspond to a population with an even age distribution.

We conducted multivariate analyses of injury outcome by Poisson regression (SAS PROC GENMOD, SAS version 9.1) to obtain incidence rate ratios between groups. Adjustments were made for sex, age and distance to the nearest hospital. The population unit was one year child. Overdispersion was accounted for by adjustment with Pearson dispersion, giving conservative estimations of confidence intervals. We carried out Poisson regression analysis separately for each injury type. Percentages of products involved and their 95%-confidence intervals were calculated.

Results

A total of 38 215 children living in the 32 municipalities during the period 1998–2003 made 50 561 visits to an emergency department for home injuries. The population in the 32 municipalities consisted of 173 504 children (four times 43 376 in the random sample), who were observed for a total of 756 440 years. The crude and age-adjusted incidence rates of home injuries were 66.8 and 66.6 per 1000 years at risk, respectively.

In total, 1597 injuries resulted in an admission (3.2% of the injuries or 2.1 per 1000 years); 1636 injuries (3.2% of the injuries or 2.2 per 1000 years) were caused by falls from 1 m or more, 3406 (6.7% injuries or 4.5 per 1000 years) were due to crushing, 1482 (2.9% of the injuries or 2.0 per 1000 years) were burns and 1051 (2.1% of the injuries or 1.4 per 1000 years) were poisonings. The age-adjusted incidence rates for the different population groups are shown in table 2.

Table 1 Some socio-demographic characteristics of the study area (32 municipalities) compared to the whole of Denmark. Percent of persons or buildings

Factor	Study area (%)	Denmark (%)
Tertiary education, women	19	22
Secondary education, women	40	39
Detached, row houses	58	54
Flats	36	38
Farm houses	3	5
Houses 5 rooms or more	27	28
Houses 2 rooms or less	22	24

The results of the Poisson regression analysis with adjustment for age, sex and distance to the nearest hospital are shown in table 3.

In comparison with the reference group, the risk of injury was higher for children in families with the lowest income, for those in families with only primary education, for those whose mothers were younger than 25 years at the time of their birth and for those living in flats. For these groups, the risk for all injury types increased. Children living with a single parent had increased risks for all types of injury except falls. Being one of three or more children in a family increased the risk for all injuries except burns and poisoning. Living in a crowded residence increased the risk for home injuries in general. Living in a flat increased the risk for all home injuries except poisoning. Living in a farmhouse increased the risks for falls, crushing and admission for a home injury. An age-dependent analysis showed that the social inequality in home injury was nearly the same for all age groups.

Home injuries due to a fall from higher level usually involved playground equipment (23 ± 2%), trees (14 ± 2%), bunk beds (12 ± 2%), horses (9 ± 2%), roof of buildings (4 ± 1%) and baby changing tables (2 ± 1%).

Burns were caused by cookers (24 ± 2%), hot water (18 ± 2%), tea (12 ± 2%), coffee (8 ± 2%), wood-burning stoves (5 ± 1%), fires (4 ± 1%), irons (3 ± 1%), barbecues (2 ± 1%), hot oil or fat (2 ± 1%) and soup (2 ± 1%). Poisoning was caused by medicines (17 ± 2%), detergents (14 ± 2%), cigarettes (9 ± 2%), vitamins (8 ± 2%), wild flora (8 ± 2%), perfumes and cosmetics (6 ± 2%) and lamp oil (3 ± 1%). Table 4 shows the large social differences for injuries involving hot liquids, burns on cookers and poisoning by chemicals or medicine, while falls from bunk beds depended on the number of children and crowding.

Poisson regression analysis was performed using a model that included all the significant factors shown in table 3. It showed that low income remained a significant risk factor for all types of injury except falls from higher level. Low-educational level remained significant for all injury types except burns and admission for a home injury. Young maternal age remained significant except for falls and poisoning. Living with a single parent did not increase the risk of injury, and living in a stepfamily or in a crowded residence decreased the risk for crushing and for home injuries in general.

Discussion

The results of this study show that social differences in childhood home injuries depend on the injury mechanisms and the products involved. These differences were not dependent on the age of the child.

Children with young mothers and mothers with only primary school education had higher risk for most types of injuries than other children. There was a higher risk up to a maternal age of 30 years. These results are similar to a Swedish study of injuries in children below 3 years,[6] where the risk for falls and poisoning were higher for children with young mothers, while maternal education in contrast to the present study only affected scalds. Children living in families with three or more siblings had higher risk of injury than only children, as found previously.[5–7] This may be explained by less parental supervision of each child, and by interactions between the children, e.g. leading to crunching of the fingers in doors. When we adjusted for the other sociodemographic factors, living with a single parent or in a stepfamily had no effect on the home injury risk, as found by others.[9,10] In contrast to what has been found in some studies[6,17] the type and size of

Table 2 Age-adjusted incidence rates (per 1000) of childhood home injuries in Denmark, 1998–2003, by social factors

Social factor	Population years (%)	Any home injury	Admitted after home injury	Fall from ≥ 1 m	Crush	Burn	Poisoning
All children		66.6	2.1	2.1	4.5	2.0	1.4
Boys	51	70.4	2.4	2.3	4.4	2.2	1.5
Girls	49	62.7	1.9	2.0	4.6	1.8	1.3
Age of mother at childbirth (years)							
<25	23	82.1	2.6	2.4	5.3	2.9	2.0
25–29	40	66.7	2.1	2.2	4.6	1.9	1.4
≥30	37	58.0	1.9	1.9	4.0	1.8	1.2
No. of children							
1	21	64.3	2.0	1.8	3.9	2.1	1.4
2	51	66.2	2.0	2.1	4.7	1.8	1.4
≥3	28	70.0	2.5	2.5	5.0	2.4	1.6
Family type							
Two parents	78	63.8	2.0	2.1	4.3	1.9	1.4
Step-family	6	75.8	3.7[b]	1.7	4.9	1.8	1.6
Single parent	16	79.0	2.5	2.3	5.4	2.6	2.1
Highest education							
Primary	16	85.8	2.8	2.6	5.7	2.8	2.1
Secondary	49	68.1	2.1	2.2	4.8	2.0	1.5
Tertiary	35	55.8	1.8	1.8	3.6	1.8	1.1
Highest income (DKK)							
<100 000	21	81.5	2.7	2.4	5.5	2.9	1.9
100 000–199 999	38	67.6	2.2	2.2	4.5	2.1	1.4
200 000–299 999	23	60.7	1.8	2.0	4.1	1.6	1.2
≥300 000	18	54.7	1.7	2.0	3.8	1.5	1.1
Crowded dwelling							
Yes	21	70.8	2.2	2.3	4.7	2.4	1.5
No	79	65.4	2.1	2.1	4.4	1.9	1.4
Dwelling type[a]							
Detached or row house	69	63.1	2.0	1.9	4.3	1.7	1.4
Flat	25	78.3	2.4	2.5	4.9	2.9	1.6
Farmhouse	5	54.5	3.0	3.5	4.6	1.7	1.3
Distance to hospital (km)							
<5	43	77.2	2.1	2.2	5.3	2.2	1.5
5–9	27	64.8	2.2	2.2	3.9	2.1	1.6
10–19	23	59.0	2.1	2.1	4.1	1.9	1.3
≥20	7	35.3	2.1	1.5	2.9	1.1	0.8

a: 'Other' omitted as it comprised only 1% of the population
b: The high rate is an accidental result of age adjustment

Table 3 Injury incidence rate ratios among children in Denmark, 1998–2003, by social factors, after adjustment for sex, age and distance to hospital (95% confidence intervals in brackets)

Social factor	Any home injury	Admitted after home injury	Fall from ≥1 m	Crush	Burn	Poisoning
Mother's age at childbirth (years; reference, ≥30)						
<25	1.4 (1.3–1.5)[a]	1.4 (1.2–1.6)[a]	1.2 (1.1–1.4)[a]	1.3 (1.2–1.5)[a]	1.6 (1.4–1.9)[a]	1.6 (1.3–1.8)[a]
25–29	1.2 (1.1–1.2)[a]	1.1 (1.0–1.3)	1.1 (1.0–1.3)	1.2 (1.1–1.3)[a]	1.1 (1.0–1.2)	1.2 (1.0–1.3)[a]
No. of children (reference, 1)						
2	1.0 (1.0–1.1)	1.0 (0.9–1.1)	1.2 (1.1–1.5)[a]	1.3 (1.1–1.4)[a]	0.8 (0.7–1.0)[a]	1.0 (0.9–1.1)
≥3	1.1 (1.1–1.2)[a]	1.2 (1.1–1.4)[a]	1.5 (1.2–1.7)[a]	1.3 (1.2–1.5)[a]	1.1 (1.0–1.3)	1.2 (1.0–1.4)
Family type (reference, two parents)						
Step-family	1.1 (1.1–1.2)[a]	1.2 (1.0–1.6)	0.9 (0.7–1.1)	1.1 (0.9–1.3)	1.0 (0.8–1.4)	1.0 (0.6–1.6)
Single parent	1.2 (1.1–1.3)[a]	1.2 (1.1–1.4)[a]	1.1 (1.0–1.3)	1.2 (1.1–1.3)[a]	1.3 (1.1–1.5)[a]	1.5 (1.2–1.8)[a]
Highest education (reference, tertiary)						
Primary	1.5 (1.5–1.6)[a]	1.5 (1.3–1.8)[a]	1.4 (1.2–1.7)[a]	1.6 (1.4–1.7)[a]	1.6 (1.4–1.9)[a]	1.9 (1.6–2.3)[a]
Secondary	1.2 (1.2–1.3)[a]	1.1 (1.0–1.3)[a]	1.2 (1.1–1.4)[a]	1.4 (1.3–1.5)[a]	1.2 (1.0–1.3)[a]	1.4 (1.2–1.6)[a]
Highest income (DKK; reference, ≥300 000)						
<100 000	1.5 (1.4–1.6)[a]	1.6 (1.3–1.9)[a]	1.2 (1.0–1.4)[a]	1.4 (1.3–1.6)[a]	1.9 (1.6–2.3)[a]	1.7 (1.4–2.1)[a]
100 000–199 999	1.3 (1.2–1.3)[a]	1.3 (1.1–1.5)[a]	1.1 (1.0–1.3)	1.2 (1.1–1.3)[a]	1.4 (1.2–1.7)[a]	1.3 (1.1–1.6)[a]
200 000–299 999	1.1 (1.1–1.2)[a]	1.0 (0.9–1.2)	1.0 (0.9–1.2)	1.1 (0.9–1.2)	1.1 (0.9–1.3)	1.1 (0.9–1.4)
Crowded dwelling (reference, no)						
Yes	1.1 (1.0–1.1)[a]	1.1 (1.0–1.2)	1.1 (1.0–1.3)	1.1 (1.0–1.2)	1.2 (1.1–1.4)	1.0 (0.9–1.2)
Dwelling type (reference, detached or row house)						
Flat	1.2 (1.1–1.2)[a]	1.2 (1.1–1.4)[a]	1.3 (1.1–1.5)[a]	1.1 (1.0–1.2)[a]	1.7 (1.5–1.9)[a]	1.1 (1.0–1.3)
Farmhouse	1.1 (1.0–1.2)	1.6 (1.2–2.0)[a]	2.1 (1.6–2.8)[a]	1.3 (1.1–1.6)[a]	1.2 (0.9–1.7)	1.1 (0.8–1.6)

a: Significantly different from 1.0 at 5% level

Table 4 Incidence rate ratios for injuries related to specific products among children in Denmark, 1998–2003, by social factors, adjusted for sex, age and distance to hospital (95% confidence intervals in brackets)

Social factor	Fall from bunk bed	Fall from playground equipment	Scalding by hot water, tea, coffee	Burn on cooker	Poisoning by chemical or medicine
No. of cases	316	1403	536	343	721
Mother's age at childbirth (years; reference, ≥30)					
<25	1.1 (0.8–1.5)	1.4 (1.2–1.6)[a]	1.7 (1.3–2.2)[a]	1.9 (1.5–2.4)[a]	1.5 (1.3–1.7)[a]
25–29	1.1 (0.9–1.5)	1.2 (1.0–1.3)[a]	1.2 (1.0–1.5)	1.1 (0.8–1.3)	1.0 (0.9–1.2)
No. of children (reference, 1)					
2	3.1 (1.8–5.4)[a]	1.1 (1.0–1.3)	0.7 (0.6–0.9)[a]	0.9 (0.7–1.1)	1.0 (0.8–1.1)
≥3	3.8 (2.1–6.8)[a]	1.4 (1.2–1.6)[a]	1.2 (1.0–1.5)	1.0 (0.8–1.4)	1.2 (1.0–1.5)[a]
Family type (reference, two parents)					
Step-family	1.1 (0.6–2.0)	1.0 (0.8–1.4)	0.8 (0.4–1.6)	1.4 (0.7–2.7)	1.0 (0.6–1.6)
Single parent	1.0 (0.7–1.4)	1.2 (1.0–1.4)[a]	0.9 (0.6–1.2)	2.0 (1.6–2.5)[a]	1.4 (1.2–1.7)[a]
Highest education (reference, tertiary)					
Primary	1.1 (0.8–1.5)	1.5 (1.2–1.8)[a]	1.6 (1.3–2.1)[a]	1.8 (1.4–2.3)[a]	2.0 (1.6–2.4)[a]
Secondary	1.3 (1.0–1.6)	1.2 (1.1–1.4)[a]	0.9 (0.8–1.2)	1.2 (0.9–1.4)	1.4 (1.2–1.7)[a]
Highest income (DKK; reference, ≥300 000)					
<100 000	1.0 (0.7–1.4)	1.8 (1.5–2.1)[a]	2.4 (1.8–3.2)[a]	2.4 (1.7–3.5)[a]	1.9 (1.5–2.4)[a]
100 000–199 999	1.0 (0.7–1.4)	1.5 (1.3–1.8)[a]	1.4 (1.1–1.9)[a]	1.8 (1.3–2.5)[a]	1.4 (1.1–1.7)[a]
200 000–299 999	0.7 (0.5–1.0)	1.2 (1.0–1.4)	1.0 (0.7–1.4)	1.3 (0.9–1.9)	1.3 (1.0–1.7)
Crowded dwelling (reference, no)					
Yes	1.7 (1.3–2.1)[a]	1.2 (1.0–1.3)[a]	1.6 (1.3–1.9)[a]	1.2 (1.0–1.6)	1.0 (0.9–1.2)
Dwelling type (reference, detached or row house)					
Flat	1.2 (0.9–1.6)	1.4 (1.2–1.6)[a]	2.0 (1.7–2.4)[a]	2.1 (1.6–2.8)[a]	1.1 (1.0–1.3)
Farmhouse	0.6 (0.3–1.4)	0.8 (0.6–1.1)	0.6 (0.3–1.3)	1.2 (0.6–2.7)	1.4 (1.0–1.9)[a]

a: Significantly different from 1.0 at 5% level

the dwelling had little or no influence on the injury risk in the current study. The increased risk for children living in farmhouses may be due to exposure to machinery, tractors and animals.[18]

Especially burns and poisoning are preventable injuries. Severe burns are typically caused by cookers, hot water, tea or coffee. Prevention of burns should focus on keeping the small children away from the kitchen or at least at a safe distance from the cooker, water boilers etc. Placing drugs, cleanings agents and other dangerous substances in a safe place could prevent poisonings. Only in 8% of the Danish homes, medicines and poisons were stored in a locked cupboard.[19]

There may be several explanations for the differences in home injury risk. One reason may be differences in exposure to dangerous products and substances. A high income increases the capability to live in safe dwellings and to buy safety equipment, thus reducing the risk exposure. High education or experience related to an older age may enhance the development of safety habits, leading to injury reduction. An alternative explanation of the social differences might be differences in care-seeking behaviour. In a questionnaire survey, respondents in lower socioeconomic groups reported seeking immediate health care more often than other groups.[20] A similar result was found in a Danish study in adults, in which unskilled workers made more frequent use of emergency departments for injury treatment than other groups.[21] Social differences in care seeking might affect more severe injuries to only a minor extent, however. In our study, the same differences were found for injuries resulting in admission as for those resulting in a visit to an emergency department.

The major strength of the current study is the large study population and the use of national registers, giving information on sociodemographics that is not dependent on injury incidence. It is a weakness that the register information on income not accurately reflects the economic resources of the family. Housing cost, family size, possibly debts and unregistered income may reduce its validity as a measure of the available income and consequently result in an underestimation of the risk differences caused by income differences. Further, information was limited to what could be obtained from registers. Safety attitudes, behaviours and other factors of potential importance for the injury risk could therefore not be assessed in the current study. We included only a few children under the age of 1. As the injury rate is low among these children this would scarcely influence the results.

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Conflict of interest: None declared.

Key points

- Maternal education, income and age affected the risk of childhood injury.
- Dwelling size had no separate effect on home injury risk.
- The social differences were most pronounced for burns and poisoning.

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